# MO&DA Requirements and System Engineering

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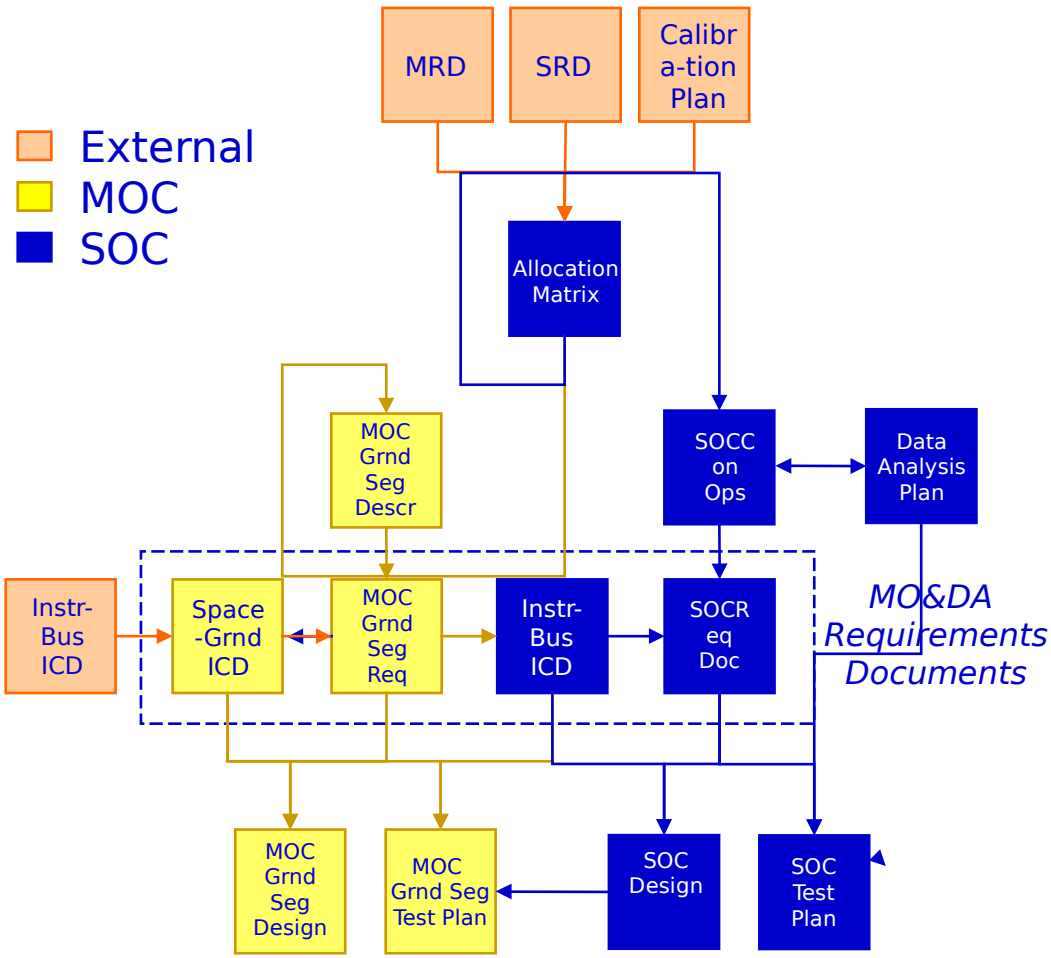
# Presentation Outline

- **Requirements Flow**
- **Documentation**
- **Requirements Allocation**
- **Data Flow Concept**
- **Interface Control**
- **Risks and Risk Mitigation**

# Requirements Flow




- **Mission Level Requirements**
  - **Mission Requirements Document**
  - **Science Requirements Document**
  - **Calibration Plan**
- **MO&DA Requirements Identified and Allocated Via Allocation Matrix**
- **Interpretation of Mission Requirements**
  - **MOC Ground Segment Description**
  - **SOC Concept of Operations**
  - **Data Analysis Plan**
- **External ICDs**
- **MO&DA System Requirements**
- **Design and Test Plans**

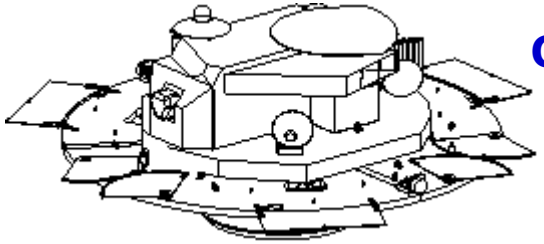
# MO&DA Documentation

| Category | Document | PDR Version | Lead Author | Description |
|---|---|---|---|---|
| | Requirements Allocation Matrix | 1.0 | Dorland | Allocation of requirements to MO&DA systems/subsystems. Contained as appendix in Req. Doc. |
| Concept of Operations | SOC Concept of Operations | 1.0 | Dorland | Overall description of SOC system. |
| | Ground Segment Description | 1.0 | Klein | Description of FAME Ground System: Emphasis on MOC. |
| | Data Analysis Plan | 2.0 | Kaplan | Description of data analysis processing concepts. |
| Requirements | SOC Requirements | 1.0 | Dorland | SOC System Requirements. |
| | Ground Software Requirements Document | 1.0 | Klein | MOC System Requirements. |
| | Space-Ground ICD | 0.8 | Dorland | Specification of interface between observatory and ground station |
| | MOC-SOC ICD | *Draft* | Dorland | Specification of interface between MOC and SOC. |
| Development | SOC Software Management Plan | 2.0 | Bangert | High-level description of software design and development policies for FAME. |
| | SOC Software Development Plan | 1.0 | Codella | Implementation of SMP. Detailed description of FAME software design and development policies, including schedules, QA, CM, etc. |
| | Ground Software Development Plan | 1.0 | Klein | Description of software development policies for MOC. |
| | SOC Design Document | 1.0 | Codella | SOC ADP system design document |

# Requirements Allocation

- **Allocation Matrix Is Contained As an Appendix in the SOC Requirements Document**
- **Allocation Matrix Identifies MRD, SRD and Calibration Plan Requirements and Assigns Each to One or More of the Following:**
  - **MOC**
  - **SOC/ADP System**
    - **Data Ingestion**
    - **Data Archive**
    - **Quicklook**
    - **Data Analysis Trending**
    - **Data Analysis**
  - **SOC/Operations**
  - **Data Simulator**
  - **Each Allocated Requirement Traced to One or More Specific System Requirements in Requirements Documents**

# MO&DA Data Flow and Interfaces



FAME Observatory

Space-Ground Interface

Housekeeping Telemetry

Instr. Data

Tasking and uploads

Ground Station

Housekeepng Telemetry

Ranging data

Instrument Data

Tasking and uploads

MOC

All Data

MOC Data Archive

SOC

Housekeeping Telemetry

Ranging data

Instrument Data

Instrument Tasking and uploads

Data Ingestion

MOC Telemetry Display

Quicklook

SOC Data Archive

Data Analysis & Trending

Operations

MOC-SOC Interface (Nominally, T-1 Speed)

- Space-Ground Interface
  - Streaming Data
- MOC Processing
  - Bundle Data Stream Into ~15 Minute Recording Files
  - Write Copies of All Data Products to Off-Line Storage
- MOC-SOC Interface
  - Primary Pipe: Discrete Files
  - Telemetry Display Pipe: Streaming
- SOC Ingest Processing
  - Unpack Recording Files
  - Make Data Available to Subsystems for Further Processing
    - Includes Off-Line Data Storage
- Data Simulator (Not Shown)
  - Simulates MOC Generated Data and Interface

# Qualification Provisions

| System/Subsystem | Qualification Provision | Comments |
|---|---|---|
| MOC | Demonstration and Test | Discussed in MOC Presentation |
| SOC-Data Ingestion | Test | Tested Using Data Simulator Output |
| SOC-Data Archive | Test | Tested Using Data Simulator Output |
| SOC-Quicklook | Test | Tested Using Data Simulator Output |
| SOC-Data Analysis and Trending | Test | Tested Using Data Simulator Output |
| SOC-Operations | Demonstration and Test | Data Simulator Output Used for Tests |
| SOC-Telemetry Display System | Test | Test to Ensure Displays Match MOC Displays |

# Risks and Risk Mitigation

| Category | Risk | Assessed Level *(Post Mitigation)* | Mitigation |
|---|---|---|---|
| Single Measurement Accuracy | Inability to Meet Single Measurement Centroiding Accuracy Requirement | Medium | Algorithm Prototyping Using Data Simulator Inputs |
| Systematic Errors | Inability to Reduce Systematic Errors Through Processing to Meet Mission Accuracy Requirements | Medium | Algorithm Prototyping Using Data Simulator Inputs |
| External Interface Stability | Data Formats and Contents Still in Flux | Low | Participate in Interface Definition Process, Adhere to Development Schedule |
| Data Throughput and Storage | Large Volume of Data May Present Processing And/or Storage Problems | Low | Hardware and Software Prototyping |
| Software Development Cost | Insufficient Budget | Low | Employ Formal SW Development Methodology |